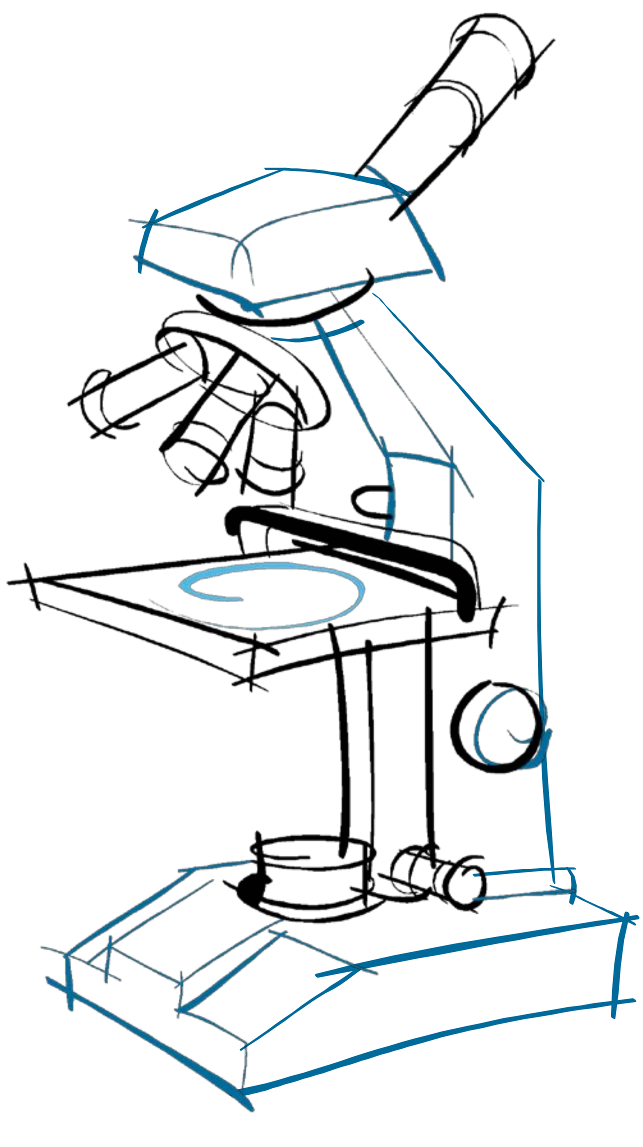
YOUNG SCHOLARS
OF WESTERN PA
CHARTER SCHOOL

# SCIENCE FAIR 2016-2017
# HANDBOOK



Dear Parents,

As you know, science, technology and engineering are basic skills expected by employers. As twenty-first century citizens, these students will also have to make some of the toughest decisions of any generation, based on their understanding of emerging science and technology.

Science fairs involve students in the practices of science and engineering, requiring them to apply those skills to a topic of interest to them. Doing science is key to understanding science.

Our school is holding a science fair on **Friday, December 2$^{nd}$**, and all students in 4$^{th}$-8$^{th}$ grades will be participating. Hands-on scientific investigation is the focus at our fair. Over an eight week period, your child will design, test, analyze, and present a project that uses scientific methods to solve a problem. The sky's the limit!

Please note that the bulk of the work will be done at home. Students will be given project guidelines and timelines at school, and teachers will check in with them periodically. However, much of the work will be self-directed. Parents are encouraged to offer emotional support and reminders but to allow children to do the projects by themselves.

We encourage you to visit the following website for valuable information designed especially for parents like you:

http://school.discoveryeducation.com/sciencefaircentral/Parent-Resources.html

Don't hesitate to call or email with any questions. Thank you very much in advance for your support!

Sincerely,

Mrs. Michael, Mr. Gurkan, Mr. Baltali, Ms. Obeid, and Mr. Pek

**Email:** s.michael@yswpcs.org, m.gurkan@yswpcs.org, b.baltali@yswpcs.org, l.obeid@yswpcs.org, r.pek@yswpcs.org
**Phone:** 412-668-2064

Science Committee | Young Scholars of Western PA Charter School

**Please sign and return by Friday September 30th, 2016**

Student's Name ___________________________

Parent's Name_____________________________

I, ___________________________ have read this booklet with my child and will consult it during the science fair process.

Parent's Signature________________________ Date_____________

The first science fair grade will be bringing this signed paper back to class by **September 30th,**

# Safety Contract

I, ___________________________, hereby certify that on this day of ___________________, I have successfully completed a review of safety procedures for a science project. I agree to follow the safety guidelines listed below. I will take every necessary precaution to operate safely throughout my experiment.

- I will follow the safety guidelines of my teacher and my school.
- I will keep my work area neat and free of unnecessary papers, books, and materials. I will keep my clothing and hair neat and out of the way. I will wear a safety apron and/or gloves if necessary.
- I know the location of all safety equipment (such as the fire extinguisher and first-aid kit) and the nearest telephone.
- I will wear safety goggles when handling chemicals, working with a flame, or performing any other activity that may cause harm to my eyes.
- I will not use chemicals, heat, electricity, or sharp objects until my teacher or parent instructs me to do so. I will follow the adult's instructions carefully.
- I will be especially careful when using glassware. Before heating glassware, I will make sure that it is made of heat-resistant material, and I will never use cracked or chipped glassware.
- I will wash my hands immediately after handling hazardous materials.

I will clean up all work areas before I leave the laboratory, put away all equipment and supplies, turn off all water faucets, gas outlets, burners, and electric hot plates.

I understand and agree to the above and all other safety precautions presented to me in class. I am hereby ready to undertake my science project with safety from this day forward.

Student name (printed) __________________________________________

Student's signature ______________________________________________

Parent's/guardian's signature ___________________________________________

# Research Paper

Provided below is a checklist of each section of the research paper that has to be included. Please use each section provided on the checklist as the headings for your research paper.

__________ 1. Title Page

__________ 2. Table of Contents

__________ 3. Abstract

__________ 4. Acknowledgements

__________ 5. Introduction

__________ 6. Purpose

__________ 7. Problem

__________ 8. Hypothesis

__________ 9. Variables

__________ 10. Materials

__________ 11. Procedure

__________ 12. Pictures

__________ 13. Data tables

__________ 14. Graphs

__________ 15. Analysis

__________ 16. Conclusion

__________ 17. Bibliography

# Science Fair Calendar

## September 2016

◄ August 2016 | October 2016 ►

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 Pick top three topic | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 Safety contract, Hypothesis | Notes: |

## October 2016

◄ September 2016 | November 2016 ►

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 Material list | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 Written Procedure | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 Results | Notes: | | | | |

## November 2016

◄ October 2016 | December 2016 ►

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 Data Table/Graph | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 Report due | 19 |
| 20 | 21 Presenting in the classroom | 22 Presenting in the classroom | 23 Presenting in the classroom | 24 | 25 | 26 |
| 27 | 28 Presenting in the classroom | 29 Presenting in the classroom | 30 Presenting in the classroom | Notes: | | |

## December 2016

◄ November 2016 | January 2017 ►

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---|---|---|---|---|---|---|
| | | | | 1 Presenting in the classroom | 2 Science Fair | 3 |

## Choose a Project Idea

The most important part of choosing a topic is picking one you're interested in. You can use books, online resources, or the objects around you to come up with a topic. Some online resources are:
http://school.discoveryeducation.com/sciencefaircentral/
http://www.sciencebuddies.org/
http://www.virtualsciencefair.com/
These websites can be useful for generating IDEAS. However, please note that you may not simply copy a procedure from the website. If you use one of these websites for a project idea you must come up with ways to modify the project to make it unique. Remember you need to know WHY you're doing what you're doing. If you don't understand the WHY of an experimental step, then you need to do more research!

## Validate Topic

As students select their topic and form their questions, they will need further guidance. Have them think about their project in terms of:
Will the investigation or building the design take more than the time allotted between now and the science fair?
Can you obtain the materials that will be required? Will the cost be too much?

## Safety

Are the tools and other materials safe for you to use? Will an adult be available to help with anything that might not be safe for you to do alone? Are any of the materials ones that someone could be allergic to?
Is the topic something that you can understand? Will the research Appropriateness: require you to read things that are too hard?

## Animal care:

If you are going to do anything with animals, you need to ask yourself will they be kept safe? Will you be putting anyone in danger? Who is allergic to the animals?

## Investigation

To learn how scientists discover things, students will conduct a hands-on investigative experiment. While scientists study a whole area of science, each experiment is focused on learning just one thing at a time. This is essential if the results are to be trusted by the entire science community.
In an investigation, students:

1. Ask a testable question
2. Research the topic
3. Make a hypothesis about the outcome based on the research or their own knowledge
4. Design the investigation
5. Conduct the investigation
6. Collect Data
7. Make sense of the data and draw a conclusion
8. Present their findings for peer review

## What is a Testable Question?

The key to a good and manageable investigation is to choose a topic of interest, then ask what is called a "testable question." Testable questions are those that can be answered through hands-on investigation by the student. The key difference between a general interest science question and a testable question is that testable questions are always about changing one thing to see what the effect is on another thing.
Here are some examples of broader science questions and testable questions:

**Broad Questions (lead to science reports)**
How do plants grow?
What makes something sink or float?
How do rockets work?
How does the sun heat up water?

**Testable Questions (lead to investigations)**
What amount of water is best to grow tomatoes? or What type of soil is best to grow petunias? or What amount of sunlight is best to grow daffodils?
How well do different materials sink or float in water? How does changing the shape of a rocket's fins change its flight? Does the sun heat salt water and fresh water at the same rate?
**Broad Questions (lead to science reports)**
What happens when something freezes?
What makes cars move?
**Testable Questions (lead to investigations)**
Do different liquids freeze at the same rate? How does the surface on which a car moves affect how fast it goes?

## Conduct Background Research

Once students have a testable question, it is important to do some background research. What do scientists think they already know about the topic? What are the processes involved and how do they work? Background research can be gathered first hand from primary sources such as interviews with a teacher, scientist at a local university, or another person with specialized knowledge. Students can use secondary sources such as books, magazines, journals, newspapers, online documents, or literature from non-profit organizations. Don't forget to make a record of any resource used so that credit can be given in a bibliography.

## Background Research:

1. Helps students gain in-depth knowledge about the topic and processes they will be observing during the investigation.
2. Sparks ideas about different variables to test when setting up the investigation.
3. Provides the basis for predicting what will happen in the investigation when making a hypothesis.
4. Provides the understanding needed to interpret and explain the results to others – especially a science fair judge!

The library is where many students get their ideas. Many students get their ideas from library books or even from the internet. If you start researching early on in the process, you can get an idea of how much information has been written about your topic. Even though your goal is to design your own experiment, you're still going to have to research the topic. You will want to get some background information and determine how to go about testing your hypothesis. So don't be afraid of research. In the long run it will actually make your project much easier for you.

## Citing All Your Sources:

Your sources may include books, magazines, newspapers, web sites, television programs, videos, or even interviews with live people. You will need to include all of these sources in the bibliography for your research paper. Your science project journal is the perfect place to keep track of this information.

## How to Cite a Reference:

In your science project journal, record the title, author, publisher, and copyright date of each source that you use. If you perform an interview, record who you spoke to, what you discussed, and when and where the interview took place. You can keep all this information organized by devoting a few journal pages to your notes on information sources.

## Compose Hypothesis

After gathering background research, students will be better prepared to formulate a hypothesis. More than a random guess, a hypothesis is a testable statement based on background knowledge, research, or scientific reason. A hypothesis states the anticipated cause and effect that may be observed during the investigation.
Consider the following hypothesis:
If ice is placed in a Styrofoam container, it will take longer to melt than if placed in a plastic or glass container. I think this is true because my research shows that a lot of people purchase Styrofoam coolers to keep drinks cool.

The time it takes for ice to melt (dependent variable) depends on the type of container used (independent variable.). A hypothesis shows the relationship among variables in the investigation and often (but not always) uses the words if and then.
Take a look at these additional examples:

1. If a mixture of vinegar and baking soda are used, then more stains may be removed. I think this because vinegar and baking soda are used in many different cleaning products.
2. When an object has a volume greater than 30 cubic centimeters, then it will sink in water. In the past I have seen big objects sink.

## Design Experiment

Once students formulate a hypothesis for their investigation, they must design a procedure to test it. A well-designed investigation contains procedures that take into account all of the factors that could impact the results of the investigation. These factors are called variables.
There are three types of variables to consider when designing the investigation procedure.

1. The independent variable is the one variable the investigator chooses to change.
2. Controlled variables are conditions that are kept the same each time.
3. The dependent variable is the variable that changes as a result of/or in response to the independent variable. It is measured or observed to see if it changes when the independent variable changes.

Having students talk through the investigation will help them to clarify the different variables involved in the experimental design. What factors will change? What factors will stay the same? What factors will be measured or observed for changes?
A hands-on way to introduce a fair test is to ask students, "Who can make the best paper airplane?" Once two students are selected to compete, hand one a large piece of construction paper and the other a piece of regular copy paper. Students will immediately note that this is "unfair." If we want the test to be fair, only the paper airplane design can be different. Everything else, including how hard the airplane is tossed, must be the same.
**Step A** – Clarify the variables involved in the investigation by developing a table such as the one below.

## Testable Question

What detergent removes stains the best?
What is changed? (Independent variable)
Type of detergent, type of stain
What stays the same? (Controlled variables)
Type of cloth, physical process of stain removal
Data Collected (Dependent variable)
Stain fading over time for combinations of detergents and stains
**Step B** – Make a list of materials that will be used in the investigation.
**Step C** – List the steps needed to carry out the investigation.
**Step D** – Estimate the time it will take to complete the investigation. Will the data be gathered in one sitting or over the course of several weeks?
**Step E** – Check the work. Ask someone else to read the procedure to make sure the steps are clear. Are there any steps missing? Double check the materials list to be sure all to the necessary materials are included.

## Set Up and Collect Data

After designing the procedure and gathering the materials, it is time to set up and to carry out the investigation. When setting up the investigation, students will need to consider...
Choose a low traffic area to reduce the risk of someone accidentally tampering with the investigation results—especially if the investigation lasts for several weeks.
Avoid harmful accidents by using safe practices.

**Safety:**
1. The use of construction tools or potentially harmful chemicals will require adult supervision.
2. Locate the nearest sink or fire extinguisher as a safety precaution.
3. Determine how to dispose of materials. For example, some chemicals should not be mixed together or put down a sink drain.
4. Wear protective clothing such as goggles and gloves. Tie back loose hair so that it does not get caught on any of the equipment.

Making a rough sketch or recording notes of the investigation set up is helpful if the experiment is to be repeated in the future.

Carrying out the investigation involves data collection. There are two types of data that may be collected—quantitative data and qualitative data. Students should collect both types of data.

## Quantitative Data

1. Uses numbers to describe the amount of something.
2. Involves tools such as rulers, timers, graduated cylinders, etc.
3. Uses standard metric units (For instance, meters and centimeters for length, grams for mass, and degrees Celsius for volume.

## Qualitative Data

As data is collected it can be organized into lists and tables. Organizing data will be helpful for identifying relationships later when making an analysis. Encourage students to make use of technology such as spreadsheets to organize their data.
1. Uses words to describe the data
2. Describes physical properties such as how something looks, feels, smells, tastes, or sounds.

## Analyze Data and Draw Conclusions

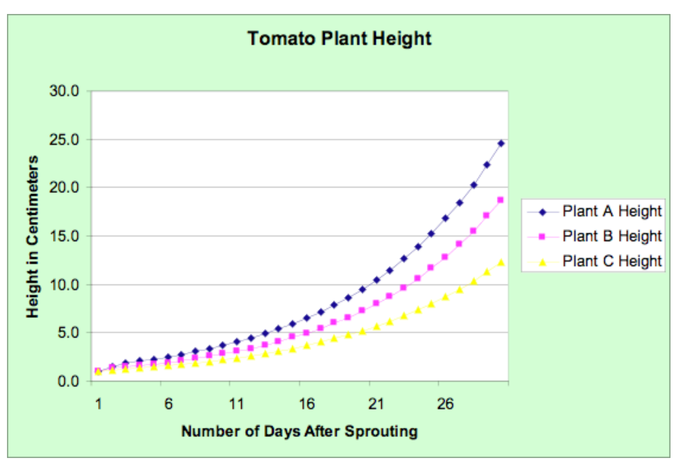
After students have collected their data the next step is to analyze it. The goal of data analysis is to determine if there is a relationship between the independent and dependent variables. In student terms, this is called "looking for patterns in the data." Did the change I made have an effect that can be measured?

Besides analyzing data on tables or charts; graphs can be used to make a picture of the data. Graphing the data can often help make those relationships and trends easier to see. Graphs are called "pictures of data." The important thing is that appropriate graphs are selected for this type of data. For example, bar graphs, pictographs, or circle graphs should be used to represent categorical data (sometimes called "side by side" data). Line plots are used to show numerical data. Line graphs should be used to show how data changes over time. Graphs can be drawn by hand using graph paper or generated on the computer from spreadsheets.

## TIP

When you create a graph make sure that you leave equal spaces between the numbers on the axes and that you number the axes consistently. For instance, if you start with the number 0 and the next values are 5 and 10, you can't skip to 20. The next number would have to be 15.

## Example:



**You can use these questions to help guide students in analyzing their data:**
1. What can be learned from looking at the data?
2. How does the data relate to the student's original hypothesis?
3. Did what you changed (independent variable) cause changes in the results (dependent variable)? After analyzing the data, students will be able to answer these questions as they draw some conclusions. Students should not to change their hypothesis if it does not match their findings. The accuracy of a hypothesis is NOT what constitutes a successful science fair investigation. Rather, Science Fair judges will want to see that the conclusions stated match the data that was collected.

## Display Board

## Your display can reflect your personality:

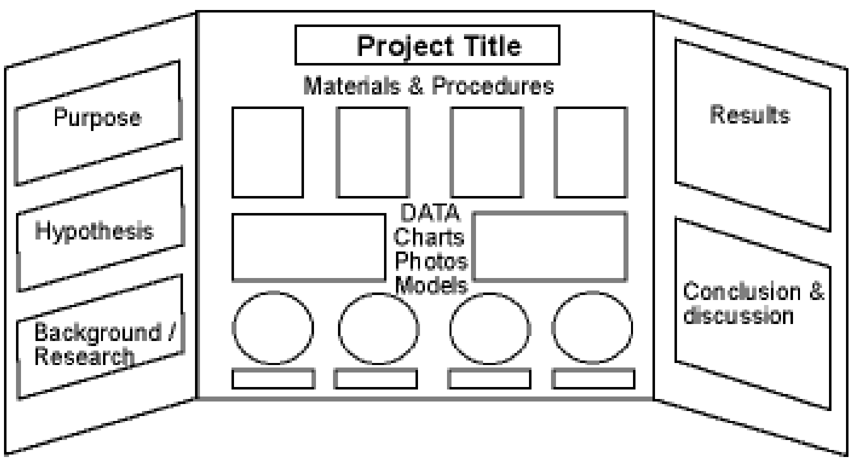
Is every inch of my locker or bedroom covered with magazine clippings, posters, stickers, and sticky notes? Or am I more of a minimalist? What's my idea of a good time: scrapbooking or skateboarding? Is the presentation the part of the science fair I've been waiting for, or is that the part I dread?

## Stand Out from the Crowd

Whether they're the kind of person who loves to design and decorate and dabble with computer graphics, or the one who always opts for the standard black-and-white report cover, this is a time for students to get creative. The stakes are high here and they'll want their personality to shine through.
They can learn how to edit their text down to the essentials, pick and choose the best photos and graphics, and display them all in the most clear and compelling way possible. Through creative use of color, type and graphic elements, your students can make their ideas pop and bring their projects to life.

## Please Refer to the Following Websites to See the Layout of Some Display Boards:

http://school.discoveryeducation.com/sciencefaircentral/
http://www.sciencebuddies.com/science-fair-projects/project_display_board.shtml




- Instead of the purpose have your testable question.
- Your results can refer to your data and analysis.
- You MUST have graphs or tables on your board.
- You don't need to follow this order exactly but it must be organized and easy to read.
- Please don't bring your project to the fair unless it is very small and can sit in front of the project without covering anything.
- No live animals please.
- When in doubt ASK YOUR TEACHER!

## Oral Presentation for Your Classmates

The student will present their project to the rest of the class in order to practice talking to judges. The presentation should be 3-5 minutes long, briefly covering most of the parts of the project. This will be done some time very close to the science fair and you will use your display board to do it.

## On Science Fair Competition Day

Your teacher will give you more details regarding dress code, the time and where the fair will be held at a later date. You will not bring anything but a book, homework or paper for drawing during the judging period. No electronics of any kind. These will be professionals coming to judge you so you need to act as professional as possible. We will talk more about this in class.

## Tricks of the Trade

Here are more suggestions that may help you during the science fair:

- Carry an index card with an outline of what you want to say, and refer to it if you forget something during your presentation.
- Don't read to the judges from your report or from notes—they would rather hear you speak naturally.
- Offer a copy of your report to the judges so that they can read about what you have done.
- If a judge asks you a question that you are unable to answer, stay calm. Explain that you aren't sure about the answer to that question, and offer to explain a part of the project that you're more comfortable with.
- If a judge asks you a question that you are unable to answer, stay calm. Explain that you aren't sure about the answer to that question, and offer to explain a part of the project that you're more comfortable with.